

# The Relationship between Air Pollution and Lung Function in Asthmatic Children

October 23, 2008



*California Environmental Protection Agency*

**Air Resources Board**

Thank you, Mr. Goldstene.

Good morning, Chairman Nichols and members of the Board.

Asthma is different from other diseases linked with air pollution in that it affects large numbers of children. While heart disease, strokes and cancer predominantly affect older adults, asthma strikes people of all ages, including infants and children, with debilitating and potentially life-threatening consequences.

For today's update, I will present the results of a study that examines the relationship between exposure to air pollution and lung function in young asthmatic children.

## Asthma is a Major Children's Health Problem

- Asthma is the leading cause of chronic illness in U.S. children
- 16% of California children suffer from asthma
- 28% of California children with daily or weekly asthma symptoms miss at least one week of school per year
- \$500 million per year in California



Asthma is the leading cause of chronic illness in American children, according to the Center for Disease Control's National Health Interview Surveys.

In 2005, an estimated 16 percent or 1.5 million children in California had been diagnosed with asthma at some point in their lives. The prevalence is rising – four years earlier it was 14 percent.

A report recently released by researchers at UCLA stated that 28% of the children in California who suffer from daily or weekly asthma symptoms miss at least one week of school per year.

The cost of treating children with asthma in California is estimated to be around 500 million dollars per year.

## Previous Findings on Air Pollution and Asthma in Children

- Children living near traffic are more likely to have asthma and suffer worse symptoms
- Children exposed to ozone and PM are more likely to visit the ER for asthma
- 9-16 year olds active outdoors in high-ozone areas more likely to develop asthma

At present, the causes and risk factors for developing asthma are a subject of active research. Asthma appears to be the result of a very complex interaction of genetic susceptibility and outdoor and indoor environmental factors.

The link between air pollution and asthma is well established. Several past health updates have focused on this subject.

A growing body of research shows that children who live near traffic are more likely to have asthma, and suffer worse symptoms. Numerous studies in California and elsewhere have confirmed this effect.

Studies have also clearly demonstrated that children exposed to higher ambient levels of ozone and particulate matter are more likely to be admitted to emergency rooms for acute asthma symptoms.

The evidence that air pollution plays a role in causing asthma is not as strong. However, the ARB's Children's Health Study found that 9-16 year olds who were active outdoors and lived in high-ozone areas were more likely to develop asthma.

## Fresno Asthmatic Children's Environment Study (FACES)

- Examine the effect of long-term exposure to air pollution on Fresno children
- Today's study: to what extent does prenatal and early-life exposure to air pollution impair lung function in young asthmatic children?

---

Mortimer, et al., *Air Pollution and Pulmonary Function in Asthmatic Children Effects of Prenatal and Lifetime Exposures*, Epidemiology 19(4), July 2008 (Funded by ARB and the American Lung Association, National and East Bay of California Chapters)

Parts of the Central Valley suffer much higher rates of asthma among children than the rest of state. The rate of illness in Fresno County, for example, is 50% higher than the statewide rate.

The Fresno Asthmatic Children's Environment Study, or FACES, was initiated to study how air pollution may contribute to this problem. Mostly funded by the ARB, FACES was designed to examine the effect of long term exposure to air pollution on the course of childhood asthma.

Today's study is the first to report findings from FACES. The main question it sets out to answer is: to what extent does prenatal and early-life exposure to air pollution impair lung function in young asthmatic children?

## Study Population

- 232 asthmatic children in Fresno, age 6-11
- 14% African American, 38% Hispanic, 45% White
- 43% from low or moderate income families
- 9% of mothers smoked during pregnancy



The study examined 232 asthmatic children in the Fresno urban area, aged 6 to 11. The study group was drawn from a broad spectrum of California's population:

14 percent of the children were African American, 38 percent were Hispanic, and 45 percent were white non-Hispanic.

Almost half of the children were from low or moderate income families, whose household income was less than thirty thousand dollars per year.

9 percent of the children's mothers smoked during pregnancy.

## Pollution Exposure and Lung Function

- Prenatal and early childhood exposure to NO<sub>2</sub>, CO, ozone, PM<sub>10</sub>
- Measures of lung function
- Sophisticated statistical methodology



To estimate exposure, pollutant concentrations were spatially interpolated to each child's home address, then averaged over key developmental periods in the child's life: the three trimesters of gestation, the entire gestation period, the first 3 and first 6 years of life, and lifetime.

To assess the severity of their asthma, each child's lung function was measured using spirometry, as shown here.

This information was used to construct statistical models to relate lung function to pollution exposure, medical history, socio-economic status, ethnicity and other factors. The study used a sophisticated, recently developed statistical methodology to find the factors with the strongest impact on lung function.

## Results

- Children most exposed to CO, PM10 and NO<sub>2</sub> experienced up to 8% reduction in lung function compared to those least exposed
- Timing of exposure is important
  - PM10, NO<sub>2</sub> - prenatal
  - CO - prenatal and first 6 years

The investigators found that the children most exposed to carbon monoxide, PM10 and nitrogen dioxide suffered a reduction of up to 8 percent in lung function, compared to the children who were least exposed.

What is even more striking is that the timing of the exposure is important. The investigators found a particularly strong association between prenatal exposure and reduced lung function for all three pollutants. For carbon monoxide, the first six years of life was also a critical window of exposure. Taken together, these findings suggest that prenatal and early-life exposures to these pollutants may lead to reduced lung function in young asthmatic children.

## Implications

- Reducing exposure to air pollution is important for improving the health of asthmatic children
- Association between prenatal exposure and reduced lung function shown in this study
- Additional research is underway



The study presented today underscores the importance of reducing air pollution exposure in improving the health of asthmatic children, a substantial proportion of the children in California.

It found an association between prenatal exposure and reduced lung function, and additional research is underway that addresses other aspects of the role of air pollution in children's asthma.

For example the ARB is currently funding analyses of two large surveys, the California Health Interview Survey and the Los Angeles Family and Neighborhood Survey, to answer questions about the effect of environment, socio-economic status, genetic susceptibility and pollution exposure on asthma response. Results from these studies should become available in the next few years and will continue to expand our knowledge of the disease.

This concludes the presentation. We'd be happy to answer any questions you may have.